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(54) LOW PROFILE OPTICAL DEVICE WITH MULTIPLE MOUNTING CONFIGURATIONS

FLACHE OPTISCHE VORRICHTUNG MIT MEHREREN MONTAGEKONFIGURATIONEN

DISPOSITIF OPTIQUE PLAT A CONFIGURATIONS DE MONTAGE MULTIPLES

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Description

Background

[0001] The present invention concerns optical devices and particularly a low profile optical device which has various possible mounting configurations.

[0002] In recent years, there continues to be a trend to lightweight portable communication systems, such as portable computers, mobile accessory units and cellular phones. These portable devices require new technologies to achieve the goals of small size, light weight and convenience for users. One of the most important new technological areas is wireless communication.

[0003] For example, miniature radio frequency (RF) communication systems allow computer users to connect to networks without a physical connection to a telephone line. Using such RF system it is possible, for example, to access electronic mail systems. This allows for great flexibility, for example, to users who are traveling.

[0004] RF transmission is also used for short range data transmissions, for example through an RF local area network (LAN). One disadvantages of RF LANs is that, due to the nature of RF circuits, systems which use RF LANs are currently very expensive. Additionally, RF LANs may be subject to FCC restrictions. Additionally, it is currently difficult to assure data security across RF LANs.

[0005] Another form of wireless communication is infrared (IR) data transmission. Systems which operate in accordance with the Infrared Data Association (IrDA) physical layer specifications can perform peer-to-peer data communication at a rate of transmission up to 115.2 kilobits per second. Systems which operate in accordance with the IrDA-Extended physical layer specifications can perform peer-to-peer data communication at a rate of transmission up to 4 megabits per second.

[0006] Typically, modules are used to implement the IrDA and the IrDA-Extended physical layer. These modules generally include a light emitting diode (LED) used for data transmission, a photo diode used for data reception, and an integrated circuit which contains an LED drive, amplifiers and a quantizer. Existing infrared data transmission modules which implement IrDA-Extended data transmission are available, for example from Siemens Corporation having a business address of 19000 Homestead Road Cupertino, CA 95014; Irvine Sensors Corporation, having a business address of 3001 Redhill Avenue, Building III Costa Mesa, California 92626; Hewlett-Packard Company having a business address of 3000 Hanover Street, Palo Alto, CA 94043; and Temic Telefunken Microelectronic GmbH, Theresienstrasse 2 Postfach 3535, 74025 Heilbronn, Germany.

[0007] Typically, currently available modules are soldered on the top of a printed circuit (PC) board. Typically, the modules extend at least three to six millimeters above the printed circuit board. However, for some applications, such as PCMCIA cards type 2, a clearance of only 2.7 millimeters is available. This is too small a clearance to allow the use of currently available modules.

[0008] A further example of a module can be found in EP 0 582 992 A.

Summary of the Invention

[0009] In accordance with the preferred embodiment of the present invention as set forth in claim 1, an optical send-receive module is shown. The optical send-receive module includes a non-conducting frame which has a front section, a back side, and a top section. A carrier also termed lens carrier, is attached to the front section of the frame. The lens carrier includes one or more lenses which face forward. An integrated circuit carrier is placed within the top section of the frame. First metal leads electrically connect components within the lens carrier to an integrated circuit within the integrated circuit carrier. Second metal leads extend from the integrated circuit carrier, along the top section of the frame, down the back side of the frame and are bent under the frame.

[0010] In the preferred embodiment first slots are placed along the back side of the frame. The second metal leads are placed in the first slots. Also, the frame includes second slots along the top section. The first metal leads are placed in the second slots. Also, the lens carrier is attached to the front section of the frame so that a bottom of the lens carrier extends down below a bottom of the top section of the frame.

[0011] The frame is manufactured, for example, using high temperature injection molded plastic. The lens carrier and a universal chip carrier are transfer molded epoxy so that they are co-planar and are connected by the first set of metal leads. The lens carrier and the universal chip carrier are placed within the frame. The lens carrier is attached to the front section of the frame. The first set of metal leads is bent so that lenses included within the lens carrier face forward. The second metal leads are bent so that they extend from the integrated circuit carrier, along the top section of the frame, down the back side of the frame and under the frame. The lens carrier is attached to the front section of the frame so that the bottom of the lens carrier extends down below the bottom of the top section of the frame.

[0012] The optical send-receive module may be connected to a printed circuit board in at least three ways. For example, using a first attachment option, the bottom of the top section of the frame rests on the printed circuit board. The front section of the frame extends over a side of the printed circuit board so that the bottom of the lens carrier extends down below the top of the printed circuit board.

[0013] Alternately, using a second attachment option, the bottom of the top section of the frame rests on the printed circuit board. The front section of the frame ex-

tends down inside a cut out portion of the printed circuit board so that the bottom of the lens carrier extends down below the top of the printed circuit board. Using a third attachment option, the frame is flipped over so that a top of the top section of the frame rests on the printed circuit board.

[0014] Modules manufactured according to the present invention as set forth in claim 8 have several significant features which make them superior to what is available in the prior art. For example, the modules have a relatively low manufacturing cost and yet may be placed on a printed circuit board with high precision. The modules may be used to house single or multiple general purpose optical ports for light emitting diodes, lasers, sensors and so on. The modules make for a very compact package format with leads as part of the package. The modules have a minimal footprint, yet have large area on the top and bottom which may be used for pick-and-place during assembly of printed circuit boards. The modules may be mounted to have a very low profile so that they are ideal for use with PCMCIA II cards, personal digital assistants (PDAs) and other small-sized devices. The modules may be mounted on top of a printed circuit board simply by flipping the module upside down. The modules also may be mounted both recessed and lowered on the edge of printed circuit board. Alternatively, the modules may be mounted lowered with lenses extending over the edge of a printed circuit board. The module is compatible with printed circuit boards of any thickness.

[0015] The module according to the present invention is also ideal for automated mounting. The module self-aligns in the horizontal and vertical axis during mounting and soldering. There is minimized anti-parallelism. The optical axis is always perfectly adjusted to the surface and edge of the printed circuit board. There are not guide pins needed for mounting. No mechanical stress is placed on the metal leads when mounting the module. There is not uphill or downhill push required when mounting the modules.

Brief Description of the Drawings

[0016] Figure 1 shows a top view and a side view of an optical service mount technology (SMT) send/receive module, in accordance with a preferred embodiment of the present invention.

[0017] Figure 2 shows a top view and a side view of the optical SMT send/receive module shown in Figure 1, mounted so that it hangs over the edge of a printed circuit board, in accordance with a preferred embodiment of the present invention.

[0018] Figure 3 shows a top view and a side view of the optical SMT send/receive module shown in Figure 1, mounted so that it is within a cut out space of a printed circuit board, in accordance with another preferred embodiment of the present invention.

[0019] Figure 4 shows a top view and a side view of the optical SMT send/receive module shown in Figure 1, mounted on top of a printed circuit board, in accordance with another preferred embodiment of the present invention.

[0020] Figure 5 shows an LED and photo diode within a lens carrier and an integrated circuit within a universal chip carrier ready for assembly in accordance with a preferred embodiment of the present invention.

[0021] Figure 6 shows a top-front view of a frame for a optical SMT send/receive module, in accordance with a preferred embodiment of the present invention.

[0022] Figure 7 shows a bottom view of the frame shown in Figure 6, in accordance with a preferred embodiment of the present invention.

[0023] Figure 8 shows a top view of an assembled optical SMT send/receive module, in accordance with a preferred embodiment of the present invention.

[0024] Figure 9 shows a bottom view of the assembled optical SMT send/receive module shown in Figure 8, in accordance with a preferred embodiment of the present invention. Figure 10 shows a top view and a side view of a module used for wireless communication, in accordance with an alternate embodiment of the present invention.

[0025] Figure 11, Figure 12 and Figure 13 illustrate placement of a module upon a printed circuit board in accordance with a preferred embodiment of the present invention.

Description of the Preferred Embodiment

[0026] Figure 1 shows a top view and a side view of an optical surface mount technology (SMT) send/receive module 10, in accordance with a preferred embodiment of the present invention. Optical SMT send/receive module 10 has a total length 28 of, for example, 14 millimeters. Optical SMT send/receive module 10 includes a frame 11 which holds in place a lens carrier 14. Frame 11 is composed of high temperature injection molded plastic. Frame 11 has a total height 25 of, for example, 4.5 millimeters. Lens carrier 14 includes a light emitting diode lens 18 which houses a light emitting diode, and includes a photo diode lens 19 which houses a photo diode. Lens carrier 14 has a height 26 of, for example, 4 millimeters and a length 27 of, for example, 14 millimeters.

[0027] An alignment portion 12 of frame 11 is used to align optical SMT send/receive module 10 when optical SMT send/receive module 10 is mounted so that it hangs over a printed circuit board or when optical SMT send/receive module 10 is mounted within a cut-out portion of a printed circuit board. Wing portions 13 of frame 11 is used to correctly settle optical SMT send/receive module 10 on a printed circuit board when optical SMT send/receive module 10 is mounted within a cut-out portion of the printed circuit board. Each wing portion 13 extends out a distance 29 of, for example 0.6 millimeters.

[0028] A universal chip carrier 15 contains an integrated circuit which includes an LED drive, amplifiers and a quantizer. In addition universal chip carrier 15 contains several capacitors. Universal chip carrier 15 is electrically connected to the light emitting diode and the photo diode within lens carrier 14 through metal leads 17. Universal chip carrier 15 may be electrically connected to a printed circuit board through metal leads 16. Metal leads 16 travel across the top of optical SMT send/receive module 10, down the back of optical SMT send/receive module 10, and extend underneath optical SMT send/receive module 10.

[0029] Figure 2 shows a top view and a side view of optical SMT send/receive module 10 mounted so that it hangs over the edge of a printed circuit board 21, in accordance with a preferred embodiment of the present invention. Alignment portion 12 of frame 11 allows optical SMT send/receive module 10 to be self-aligned when optical SMT send/receive module 10 is mounted on printed circuit board 21. Leads 16 are soldered to printed circuit board 21 at the bottom comer of optical SMT send/receive module 10 where leads 16 extend undemeath optical SMT send/receive module 10, forming solder piles 22.

[0030] Figure 3 shows a top view and a side view of optical SMT send/receive module 10 mounted so that it is within a cut out space 33 of a printed circuit board 31, in accordance with another preferred embodiment of the present invention. Cut out space 33 has a length 33 of, for example, 13 millimeters and extends into printed circuit board 31 a depth 34 of, for example, 4 millimeters.

[0031] Wing portions 13 of frame 11 rest on printed circuit board 31 giving additional stability to optical SMT send/receive module 10. Alignment portion 12 of frame 11 allows optical SMT send/receive module 10 to be self-aligned when optical SMT send/receive module 10 is mounted on printed circuit board 31. Leads 16 are soldered to printed circuit board 31 at the bottom corner of optical SMT send/receive module 10 where leads 16 extend underneath optical SMT send/receive module 10, forming solder piles 32.

[0032] Figure 4 shows a top view and a side view of optical SMT send/receive module 10 flipped over and mounted on top of a printed circuit board 41, in accordance with another preferred embodiment of the present invention. Leads 16 are soldered to printed circuit board 41 at the corner of optical SMT send/receive module 10 where leads 16 contact printed circuit board 41, forming solder piles 42.

[0033] Figure 5 shows a top view of lens carrier 54 and a universal chip carrier 55. Lens carrier 54 includes a light emitting diode lens 58 which houses a light emitting diode, and includes a photo diode lens 59 which houses a photo diode. A universal chip carrier 55 contains an integrated circuit which includes an LED drive, amplifiers and a quantizer. Universal chip carrier 55 also contains several capacitors.

[0034] During manufacturing lens carrier 54 and universal chip carrier 55 are transfer molded epoxy around their components thus enclosing all shock sensitive semiconductor parts and bonding leads. The integrated circuit within universal chip carrier 55 is electrically connected to the light emitting diode and the photo diode within lens carrier 54 through metal leads 57. Metal leads 56 will be used to connect the integrated circuit within universal chip carrier 55 to a printed circuit board. Initially, before being joined to a frame, lens carrier 54 and universal chip carrier 55 are co-planar.

[0035] Figure 6 shows a top-front view of a frame 61 for an optical SMT send/receive module. Frame 61 is high temperature plastic injection molded. Frame 61 includes slots 62 in which will be placed metal leads 56. Frame 61 also includes slots 66 in which will be placed metal leads 57. A slot 65 in is ready to receive a lens carrier. An opening 64 is ready to receive a universal chip carrier.

[0036] Figure 7 shows a bottom view of frame 61. As also shown in the top-front view of frame 61, frame 61 includes slots 62 in which will be placed metal leads 56 and slots 66 in which will be placed metal leads 57. Metal leads 56 will be j-bent over mounting surface 67. Opening 64 is ready to receive a universal chip carrier.

[0037] Figure 8 shows a top-front view of the assembled optical SMT send/receive module. Metal leads 57 have been bent so that lens carrier 50 can be placed within slot 65. Universal chip carrier 55 has been placed within opening 64. Metal leads 57 have been placed within slots 66. Metal leads 56 have been bent so that they go around the back of frame 61, through slots 62 and are j-bent over a mounting surface 67 (shown in Figure 9).

[0038] Figure 9 shows a bottom view of the assembled optical SMT send/receive module. The bottom of universal chip carrier 55 is seen within opening 64. As shown in Figure 9, metal leads 56 have been bent so that they go around the back of frame 61, through slots 62 and are j-bent over mounting surface 67.

[0039] While the preferred embodiment discussed above includes an optical SMT send/receive module which has both a light emitting diode and a photo diode, the principles of the present invention may be adapted to any module used in wireless communication.

[0040] For example, Figure 10 shows a top view and a side view of a module 110 which is used in wireless communication, in accordance with an alternate embodiment of the present invention. Module 110 includes a frame 111 which holds in place a lens carrier 114. Frame 111 is composed of high temperature injection molded plastic. Lens carrier 114 includes a lens 118 which may house, for example, a light emitting diode, a photo diode, or some other device used for wireless communication.

[0041] An alignment portion 112 of frame 111 is used to align module 110 when module 110 is mounted so that it hangs over a printed circuit board or when module 110 is mounted within a cut-out portion of a printed circuit board. Wing portions 113 of frame 111 is used to

correctly settle module 110 on a printed circuit board when module 110 is mounted within a cut-out portion of the printed circuit board.

[0042] A universal chip carrier 115 contains an integrated circuit which includes components which control the device within lens 118. Universal chip carrier 115 is electrically connected to the device within lens carrier 114 through metal leads 117. Universal chip carrier 115 may be electrically connected to a printed circuit board through metal leads 116. Metal leads 116 travel across the top of module 110, down the back of module 110, and extend underneath module 110.

[0043] Figure 11, Figure 12 and Figure 13 illustrate placement of a module upon a printed circuit board in accordance with a preferred embodiment of the present invention. In Figure 11, a module 120 is held by a pick-and-place mechanism 129 in preparation for placement upon a printed circuit board 130. Glue 131 is placed on printed circuit board 130 in order to hold in place module 120. A vertical axis 132 shows location of the front edge of printed circuit board 130. An alignment portion 122 of module is used to align module 120 as module 120 is placed on printed circuit board 130.

[0044] In Figure 12, module 120 has been moved by pick-and-place mechanism 129 to contact printed circuit board 130. As alignment portion 122 comes into contact with printed circuit board 130, the slope of alignment portion 122 causes module 120 to be placed on printed circuit board 130 in proper alignment.

[0045] In Figure 13, module 120 has been placed in proper alignment upon printed circuit board 130. Glue 131 (shown in Figures 11 and 12) holds module 120 in place. Solder 133 is used to electrically connect metal leads of module 120 to contacts on printed circuit board 130.

Claims

1. A module (10; 110; 120) for optical communication comprising:

   a non-conducting frame (11; 61; 111) having a front, a back side, and a top section including an opening (64);
   a carrier (14; 54; 114) attached to the front of the non-conducting frame, the carrier supporting lens means (18, 19; 58, 59);
   an integrated circuit carrier (15; 55; 115) placed within the opening (64) in the top section of the non-conducting frame (11; 61; 111);
   first metal leads placed on the top section of the non-conducting frame (11; 61; 111) for electrically connecting; components received within the carrier (14; 54; 114) to an integrated circuit within the integrated circuit carrier (15; 55; 115); and
   second metal leads (16; 56; 116) which extend from the integrated circuit carrier (14; 54; 114) along the top section of the non-conducting frame (11; 61; 111), down the back side of the non-conducting frame (11; 61; 111) and extend under the non-conducting frame (11; 61; 111).

2. A module as is claim 1, wherein the frame (10; 110; 120) is composed of plastics material.

3. A module as in claim 1 or 2, wherein the frame (11; 61; 111) additionally includes:

   first slots (62) along the back side of the frame (11; 61; 111), the second metal leads (16; 56; 116) being placed in the slots (62).

4. A module as in claim 3, wherein the frame (11; 61; 111) includes second slots (66) along the top section, the first metal leads (17; 57; 117) being placed in the second slots (66).

5. A module as in claim 1 or 2, wherein the carrier (14; 54; 114) is attached to the front of the frame (11; 61; 111) so that a bottom of the carrier (14; 54; 114) extends down below a bottom of the top section of the frame (14; 54; 114).

6. A module as in claim 1 to 5, wherein the module (10; 110; 120) is an optical module (10; 110; 120), whereby the carrier (14; 54; 114) further includes a light emitting diode or a photo diode.

7. A module as in claim 1 to 5, wherein the module (10; 110; 120) is an optical module (10; 110;120), whereby the carrier (14; 54; 114) supports first lens means, a light emitting diode, second lens means, and a photo diode.

8. A method for manufacturing an optical send-receive module (10; 110; 120) comprising the following steps:

   (a) forming a non-conducting frame (10; 110; 120), the frame (10; 110; 120) having a front section, a back side, and a top section including an opening (64) ;

   (b) molding a carrier (14; 54; 114) and an integrated circuit carrier (15; 55; 115), the carrier (14; 54; 114) and integrated circuit carrier (15; 55; 115) being co-planar and being connected by a first set of metal leads (17; 57; 117), a second set of metal leads (16; 56; 116) extending out from the integrated circuit carrier (15; 55; 115); and

   (c) placing the carrier (14; 54; 114) and the integrated circuit carrier (15; 55; 115) within the

frame (10; 110; 120), wherein

the carrier (14; 54; 114) is attached to the front section of the frame (10; 110; 120), and the first set of metal leads (17; 57; 117) are bent so that a lens included within the lens carrier faces forward in direction away from the frame (10; 110; 120), and
the second metal leads (16; 56; 116) are bent so that they extend from the integrated circuit carrier (15; 55; 115), along the top section of the frame (10; 110; 120), down the back side of the frame (10; 110; 120) and extend under the frame (10; 110; 120).

9. A method as in claim 8 wherein step (a) includes forming first slots (62) along the back side of the frame (10; 110; 120), and step (b) includes placing the second metal leads (16; 56; 116) in the slots (62).

10. A method as in claim 9 wherein step (a) includes forming second slots (66) along the top section of the frame (10; 110; 120), and step (b) includes placing the first metal leads (17; 57; 117) in the slots (66).

11. A method as in claim 8 wherein step (c) includes attaching the carrier (14; 54; 114) to the front section of the frame (10; 110; 120) so that a bottom of the carrier (14; 54; 114) extends down below a bottom of the top section of the frame (10; 110; 120).

12. A method as in claim 11 additionally comprising the following step:

(d) attaching the frame (10; 110; 120) to a printed circuit board (21; 31; 130), the bottom of the top section resting on the printed circuit board (21; 31; 130), the front section extending over a side of the printed circuit board (21; 31; 130) so that the bottom of the lens carrier (14; 54; 114) extends down below a top of the printed circuit board (21; 31; 130).

13. A method as in claim 9 additionally comprising the following step:

(d) attaching the frame (10; 110; 120) to a printed circuit board (21; 31; 130), the bottom of the top section resting on the printed circuit board (21; 31; 130), the front section extending down inside a cut out portion of the printed circuit board (21; 31; 130) so that the bottom of the carrier (21; 31; 130) extends down below a top of the printed circuit board (21; 31; 130).

14. A method as in claim 8 additionally comprising the following step:

(d) attaching the frame (10; 110; 120) to a printed circuit board (21; 31; 130), the frame (10; 110; 120) being flipped over so that a top of the top section rests on the printed circuit board (21; 31; 130).

Patentansprüche

1. Modul (10;110;120) für optische Verbindung, welcher aufweist:

einen nichtleitenden Rahmen (11;61;111) mit einer Vorder- und einer Rückseite sowie einem eine Öffnung (64) enthaltenden Oberteil;
einen Träger (14;54;114), der an der Vorderseite des nichtleitenden Rahmens befestigt ist, wobei der Träger eine Linseneinrichtung (18,19;58,59) trägt;
einen integrierten Schaltungsträger (15;55; 115), der innerhalb der Öffnung (64) im Oberteil des nichtleitenden Rahmens (11;61;111) angeordnet ist;
erste Metalleitungen, die auf dem Oberteil des nichtleitenden Rahmens (11;61;111) zum elektrischen Anschließen angeordnet sind;
innerhalb des Trägers (14;54;114) aufgenommene Komponenten für eine integrierte Schaltung innerhalb des integrierten Schaltungsträgers (15;55;115); und
zweite Metalleitungen (16;56;116), die sich vom integrierten Schaltungsträger (14;54;114) längs des Oberteils des nichtleitenden Rahmens (11;61;111) über die Rückseite des nichtleitenden Rahmens (11;61;111) nach unten und unter den nichtleitenden Rahmen (11;61;111) erstrecken.

2. Modul nach Anspruch 1, bei welchem der Rahmen (10;110; 120) aus Kunststoff besteht.

3. Modul nach Anspruch 1 oder 2, bei welchem der Rahmen (11;61;111) ferner aufweist:

erste Schlitze (62) längs der Rückseite des Rahmens (11;61;111), wobei die zweiten Metalleitungen (16;56; 116) in den Schlitzen (62) angeordnet sind.

4. Modul nach Anspruch 3, bei welchem der Rahmen (11;61; 111) zweite Schlitze (66) längs des Oberteils aufweist, wobei die ersten Metalleitungen (17;57; 117) in den zweiten Schlitzen (66) angeordnet sind.

5. Modul nach Anspruch 1 oder 2, bei welchem der Träger (14;54;114) an der Vorderseite des Rah-

mens (11;61;111) derart befestigt ist, daß ein Boden des Trägers (14;54; 114) sich nach unten unter einen Boden des Oberteils des Rahmens (14;54;114) erstreckt.

6. Modul nach den Ansprüchen 1 bis 5, bei welchem der Modul (10;110;120) ein optischer Modul (10; 110;120) ist, wobei der Träger (14;54;114) ferner eine lichtemittierende Diode oder eine Fotodiode aufweist.

7. Modul nach den Ansprüchen 1 bis 5, bei welchem der Modul (10;110;120) ein optischer Modul (10; 110;120) ist, wobei der Träger (14;54;114) eine erste Linseneinrichtung, eine lichtemittierende Diode, eine zweite Linseneinrichtung und eine Fotodiode aufweist.

8. Verfahren zum Herstellen eines optischen Sende-Empfangsmoduls (10;110;120), welches die folgenden Schritte umfaßt:

(a) Ausbilden eines nichtleitenden Rahmens (10;110; 120), wobei der Rahmen (10;110;120) einen Vorderteil, eine Rückseite und einen Oberteil mit einer Öffnung (64) aufweist;
(b) Formen eines Trägers (14;54;114) und eines integrierten Schaltungsträgers (15;55; 115), wobei der Träger (14;54;114) und der integrierte Schaltungsträger (15;55;115) in der gleichen Ebene liegen und durch einen ersten Satz von Metalleitungen (17;57;117) verbunden sind, und ein zweiter Satz von Metalleitungen (16;56; 116) vom integrierten Schaltungsträger (15;55;115) ausgeht; und
(c) der Träger (14;54;114) und der integrierte Schaltungsträger (15;55;115) innerhalb des Rahmens (10;110; 120) angeordnet wird, wobei

der Träger (14;54;114) am Vorderteil des Rahmens (10; 110;120) befestigt wird und der erste Satz von Metalleitungen (17;57;117) so gebogen wird, daß eine innerhalb des Linsenträgers enthaltene Linse in Richtung weg vom Rahmen (10;110;120) nach vorne weist, und
die zweiten Metalleitungen (16;56;116) so gebogen werden, daß sie sich vom integrierten Schaltungsträger (15;55;115) längs des Oberteils des Rahmens (10;110;120) nach unten über die Rückseite des Rahmens (10;110;120) und unter den Rahmen (10;110;120) erstrekken.

9. Verfahren nach Anspruch 8, bei welchem der Schritt (a) das Formen von ersten Schlitzen (62) längs der Rückseite des Rahmens (10;110;120) umfaßt und der Schritt (b) das Anordnen der zweiten Metalleitungen (16;56;116) in den Schlitzen (62) umfaßt.

10. Verfahren nach Anspruch 9, bei welchem der Schritt (a) das Ausbilden von zweiten Schlitzen (66) längs des Oberteils des Rahmens (10;110;120) umfaßt und der Schritt (b) das Anordnen der ersten Metalleitungen (17;57;117) in den Schlitzen (66) umfaßt.

11. Verfahren nach Anspruch 8, bei welchem der Schritt (c) das Befestigen des Trägers (14;54;114) am Vorderteil des Rahmens (10;110;120) umfaßt, so daß ein Boden des Trägers (14;54;114) sich nach unten unterhalb einen Boden des Oberteils des Rahmens (10;110;120) erstreckt.

12. Verfahren nach Anspruch 11, welches zusätzlich den folgenden Schritt umfaßt:

(d) Befestigen des Rahmens (10;110;120) an einer gedruckten Schaltungsplatte (21;31; 130), wobei der Boden des Oberteils auf der gedruckten Schaltungsplatte (21; 31;130) aufliegt und der Vorderteil sich über eine Seite der gedruckten Schaltungsplatte (21;31;130) derart erstreckt, daß der Boden des Linsenträgers (14;54;114) sich nach unten unter eine Oberseite der gedruckten Schaltungsplatte (21;31; 113) erstreckt.

13. Verfahren nach Anspruch 9, welches zusätzlich den folgenden Schritt umfaßt:

(d) Befestigen des Rahmens (10;110;120) an einer gedruckten Schaltungsplatte (21;31; 130), wobei der Boden des Oberteils auf der gedruckten Schaltungsplatte (21; 31;130) aufliegt und der Vorderteil sich nach unten unterhalb eines Ausschnitteils der gedruckten Schaltungsplatte (21;31;130) derart erstreckt, daß der Boden des Trägers (21;31;130) sich nach unten unterhalb eine Oberseite der gedruckten Schaltungsplatte (21;31;130) erstreckt.

14. Verfahren nach Anspruch 8, welches zusätzlich den folgenden Schritt umfaßt:

(d) Befestigen des Rahmens (10;110;120) an einer gedruckten Schaltungsplatte (21;31; 130), wobei der Rahmen (10;110;120) umgeklappt wird, so daß eine Oberseite des Oberteils auf der gedruckten Schaltungsplatte (21; 31; 130) aufliegt.

Revendications

1. Module (10 ; 110 ; 120) pour communications optiques, comprenant :

   - un châssis non conducteur (11 ; 61 ; 111) comportant une partie avant, un côté arrière et une partie supérieure comprenant une ouverture (64) ;
   - un support (14 ; 54 ; 114) fixé à la partie avant du châssis non conducteur, ce support supportant des moyens de lentilles (18, 19 ; 58, 59) ;
   - un porte-circuit intégré (15 ; 55 ; 115) placé à l'intérieur de l'ouverture (64) formée dans la partie supérieure du châssis non conducteur (11 ; 61 ; 111) ;
   - des premiers conducteurs métalliques placés sur la partie supérieure du châssis non conducteur (11 ; 61 ; 111) pour connecter électriquement des composants reçus à l'intérieur du support (14 ; 54 ; 114), à un circuit intégré placé à l'intérieur du porte-circuit intégré (15 ; 55 ; 115) ; et
   - des seconds conducteurs métalliques (16 ; 56 ; 116) qui partent du porte-circuit intégré (14 ; 54 ; 114), passant le long de la partie supérieure du châssis non conducteur (11 ; 61; 111), descendent le long du côté arrière du châssis non conducteur (11 ; 61 ; 111), et passent sous ce châssis non conducteur (11 ; 61 ; 111).

2. Module selon la revendication 1, dans lequel

   le châssis (10 ; 110 ; 120) est constitué de matière plastique.

3. Module selon la revendication 1 ou 2, dans lequel

   le châssis (11 ; 61 ; 111) comprend en outre : des premières fentes (62) le long du côté arrière du châssis (11 ; 61 ; 111), les seconds conducteurs métalliques (16 ; 56 ; 116) étant placés dans ces fentes (62).

4. Module selon la revendication 3, dans lequel

   le châssis (11 ; 61; 111) comprend des secondes fentes (66) le long de la partie supérieure, les premiers conducteurs métalliques (17 ; 57 ; 117) étant placés dans ces secondes fentes (66).

5. Module selon la revendication 1 ou 2, dans lequel

   le support (14 ; 54 ; 114) est fixé à la partie avant du châssis (11 ; 61; 111) de façon que le bas du support (14 ; 54 ; 114) descende audessous du bas de la partie supérieure du châssis (14 ; 54 ; 114).

6. Module selon la revendication 1 à 5, dans lequel

   le module (10 ; 110 ; 120) est un module optique (10 ; 110 ; 120), de sorte que le support (14 ; 54 ; 114) comprend en outre une diode d'émission de lumière ou une photodiode.

7. Module selon la revendication 1 à 5, dans lequel

   le module (10 ; 110 ; 120) est un module optique (10 ; 110 ; 120), de sorte que le support (14 ; 54 ; 114) supporte une première lentille, une diode d'émission de lumière, une seconde lentille et une photodiode.

8. Procédé de fabrication d'un module d'émission/réception optique (10 ; 110 ; 120), comprenant les étapes suivantes consistant à :

   - a) former un châssis non conducteur (10 ; 110 ; 120) qui comporte une partie avant, un côté arrière, et une partie supérieure munie d'une ouverture (64) ;
   - (b) mouler un support (14 ; 54 ; 114) et un porte-circuit intégré (15 ; 55 ; 115), le support (14 ; 54 ; 114) et le porte-circuit intégré (15 55 ; 115) étant coplanaires et connectés par un premier jeu de conducteurs métalliques (17 ; 57 ; 117), tandis qu'un second jeu de conducteurs métalliques (16 ; 56 ; 116) sortent du porte-circuit intégré (15 ; 55 ; 115) ; et
   - (c) placer le support (14 ; 54 ; 114) et le porte-circuit intégré (15 ; 55 ; 115) à l'intérieur du châssis (10 ; 110 ; 120), de sorte que, dans cette mise en place

   - le support (14 ; 54 ; 114) est fixé à la partie avant du châssis (10 ; 110 ; 120), et les conducteurs métalliques du premier jeu (17 ; 57 ; 117) sont courbés de façon qu'une lentille incluse dans le porte-lentilles soit tournée vers l'avant dans la direction s'écartant du châssis (10 ; 110 ; 120), et
   - les seconds conducteurs métalliques (16 ; 56 ; 116) sont courbés de manière à sortir du porte-circuit intégré (15 ; 55 ; 115), à passer le long de la partie supérieure du châssis (10 ; 110 ; 120), à descendre le long du côté arrière de ce châssis (10 ; 110 ; 120), et à passer sous celui-

ci.

9. Procédé selon la revendication 8, dans lequel

l'étape (a) comprend la formation de premières fentes (62) le long du côté arrière du châssis (10 ; 110 ; 120), et
l'étape (b) comprend la mise en place des seconds conducteurs métalliques (16 ; 56 : 116) dans ces fentes (62).

10. Procédé selon la revendication 9, dans lequel

- l'étape (a) comprend la formation de secondes fentes (66) le long de la partie supérieure du châssis (10 ; 110 ; 120), et
- l'étape (b) comprend la mise en place des premiers conducteurs métalliques (17 ; 57 ; 117) dans ces fentes (66).

11. Procédé selon la revendication 8, dans lequel

l'étape (c) comprend la fixation du support (14 ; 54 ; 114) à la partie avant du châssis (10 ; 110 ; 120) de façon que le bas du support (14 ; 54 ; 114) descende au-dessous du bas de la partie supérieure du châssis (10 ; 110 ; 120).

12. Procédé selon la revendication 11, comprenant en outre l'étape suivante consistant à :

(d) fixer le châssis (10 ; 110 ; 120) à une carte de circuit imprimé (21 ; 31 ; 130) de façon que le bas de la partie supérieure repose sur la carte de circuit imprimé (21 ; 31 ; 130), que la partie avant s'étende sur un côté de la carte de circuit imprimé (21 ; 31 ; 130), et que le bas du porte-lentilles (14 ; 54 ; 114) descende au-dessous du sommet de la carte de circuit imprimé (21 ; 31 ; 130).

13. Procédé selon la revendication 9, comprenant en outre l'étape suivante consistant à :

(d) fixer le châssis (10 ; 110 ; 120) à une carte de circuit imprimé (21; 31; 130), de façon que le bas de la partie supérieure repose sur la carte de circuit imprimé (21 ; 31 ; 130), que la partie avant s'étende vers le bas pour pénétrer dans une partie de découpe de la carte de circuit imprimé (21 ; 31 ; 130), et que le bas du support (21 ; 31 ; 130) descende au-dessous du sommet de la carte de circuit imprimé (21 ; 31; 130).

14. Procédé selon la revendication 8, comprenant en outre l'étape suivante consistant à :

(d) fixer le châssis (10 ; 110 ; 120) à une carte de circuit imprimé (21; 31; 130), le châssis (10 ; 110 ; 120) étant retourné la tête en bas de façon que le sommet de la partie supérieure repose sur la carte de circuit imprimé (21 ; 31 ; 130)

FIG. 1

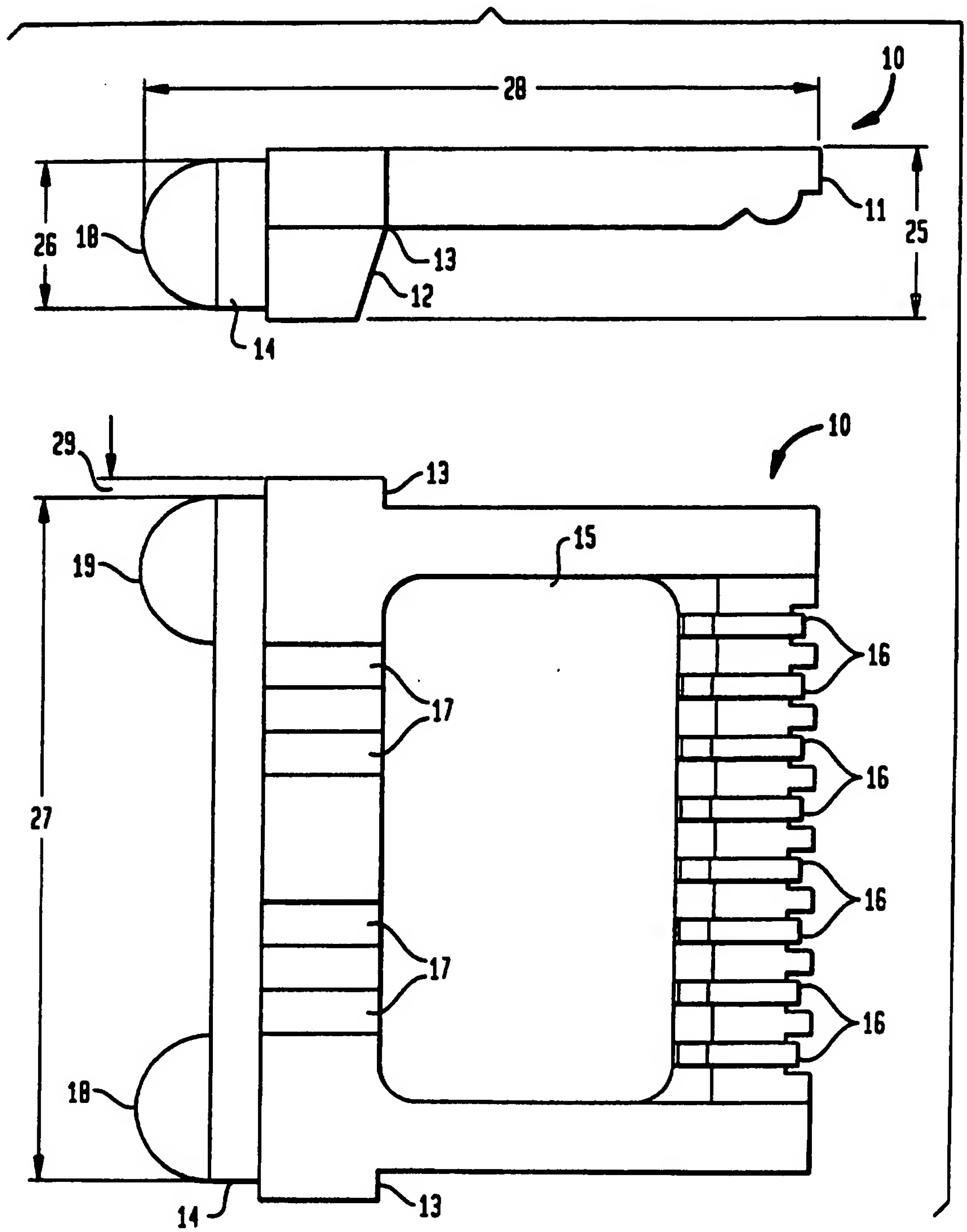

FIG. 2

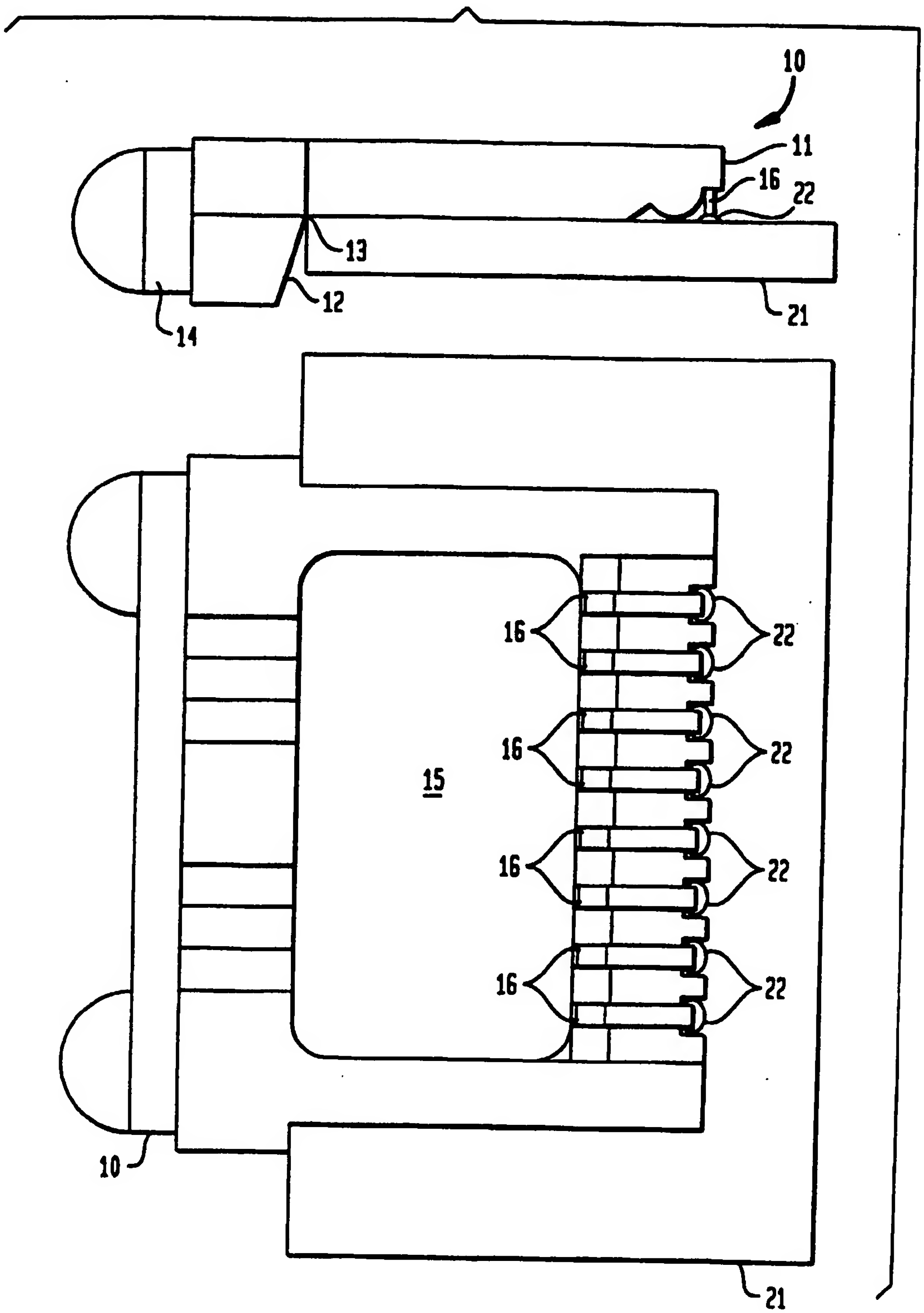

FIG. 3

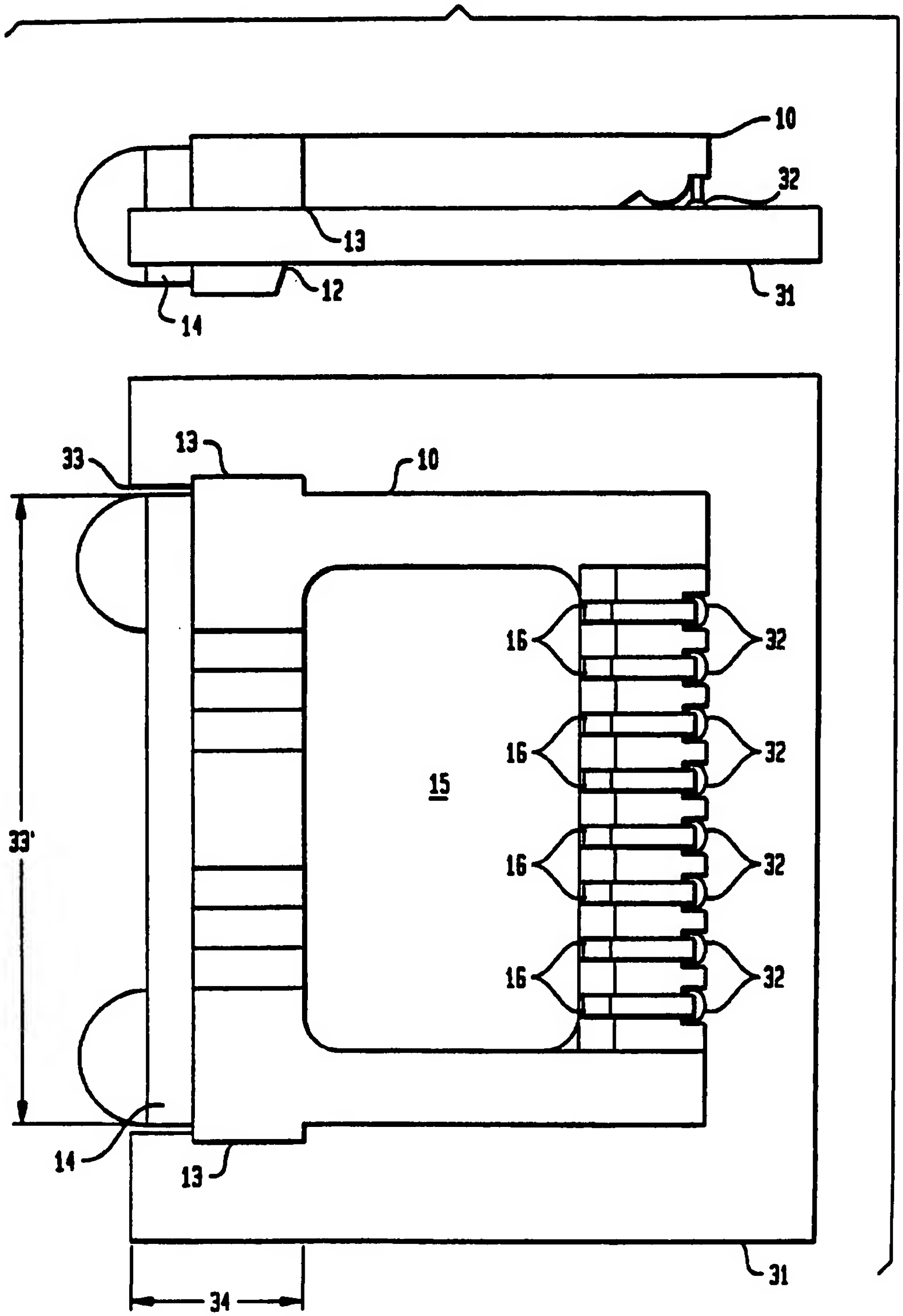

FIG. 4

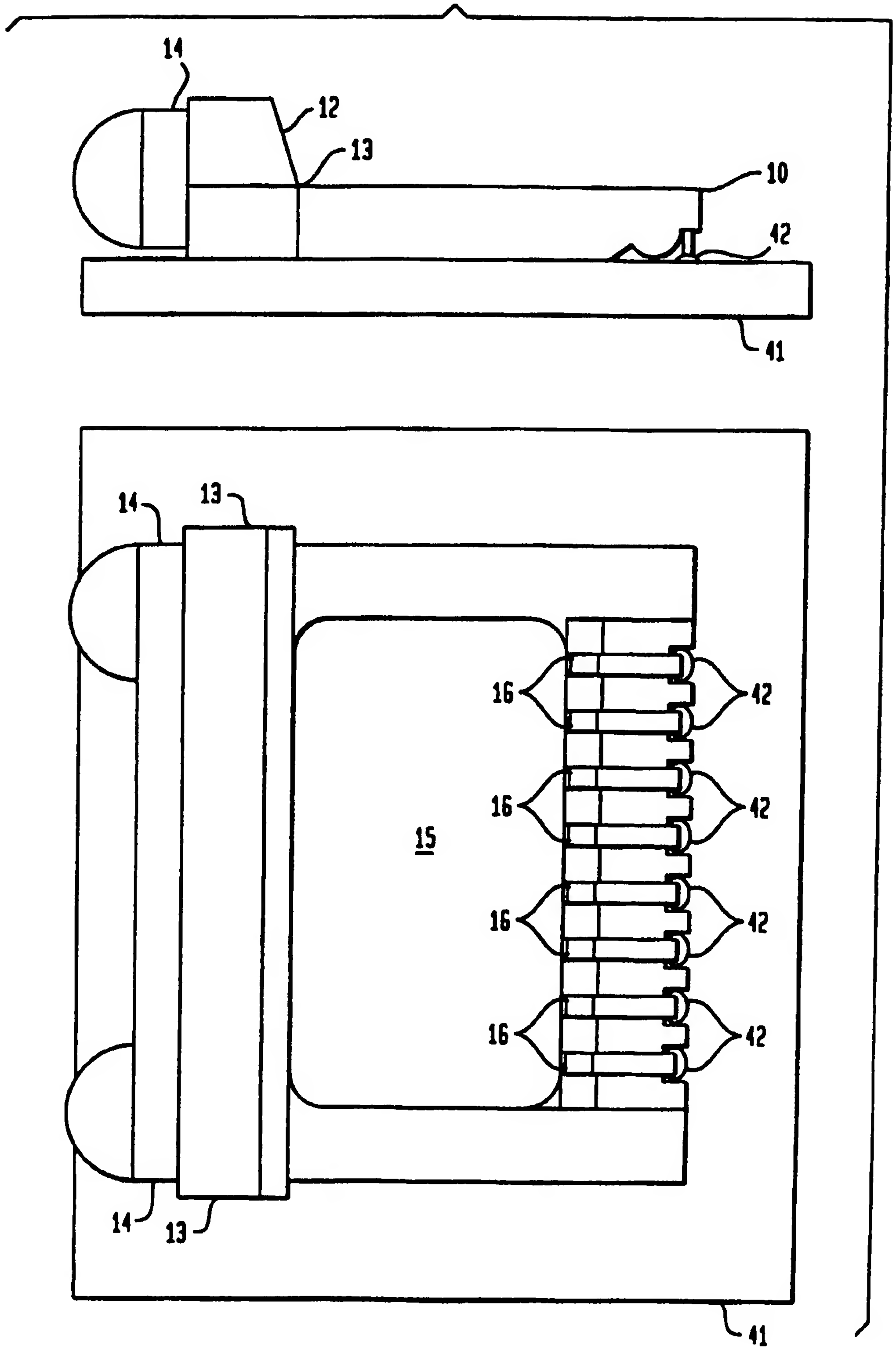

FIG. 6

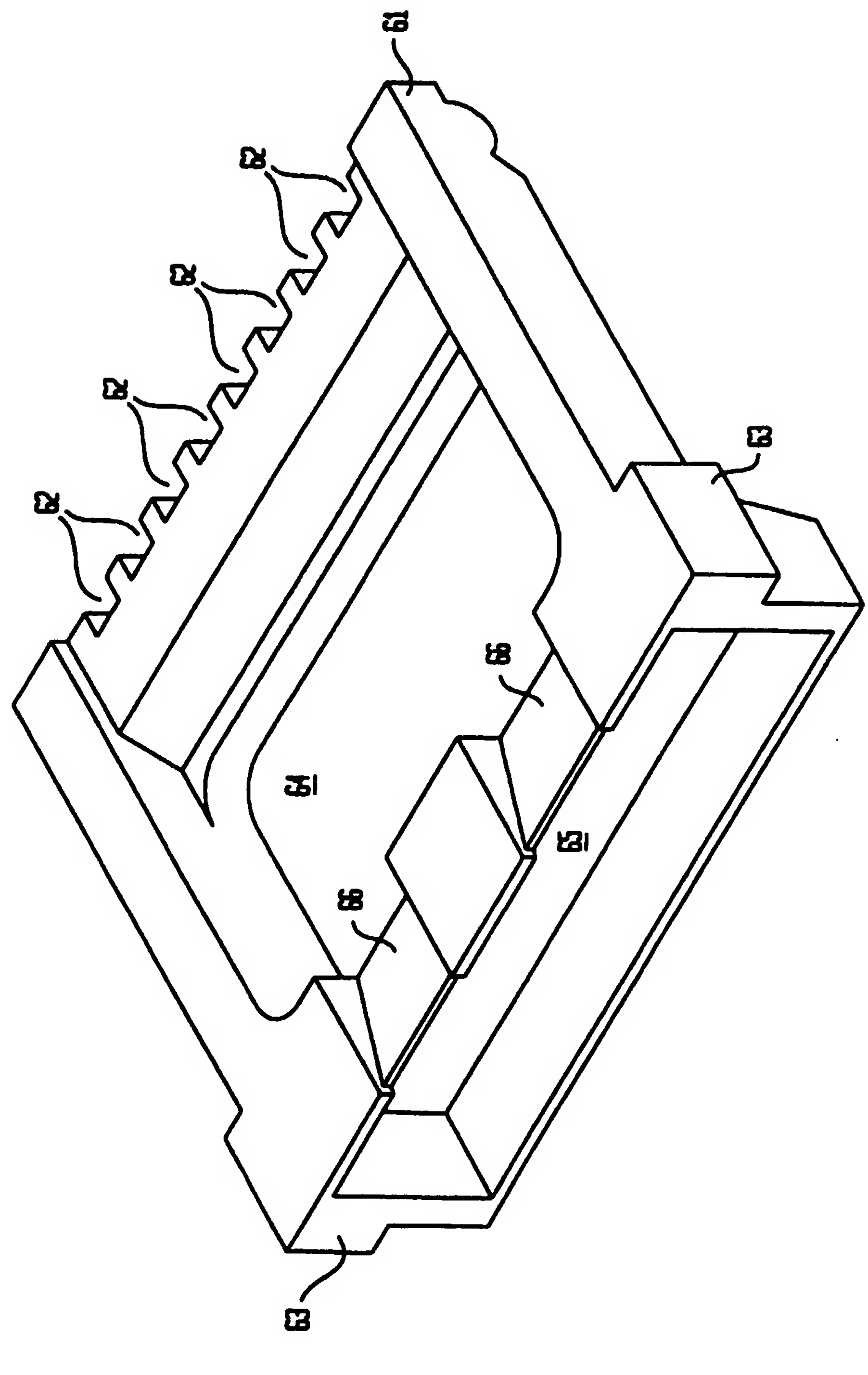

FIG. 7

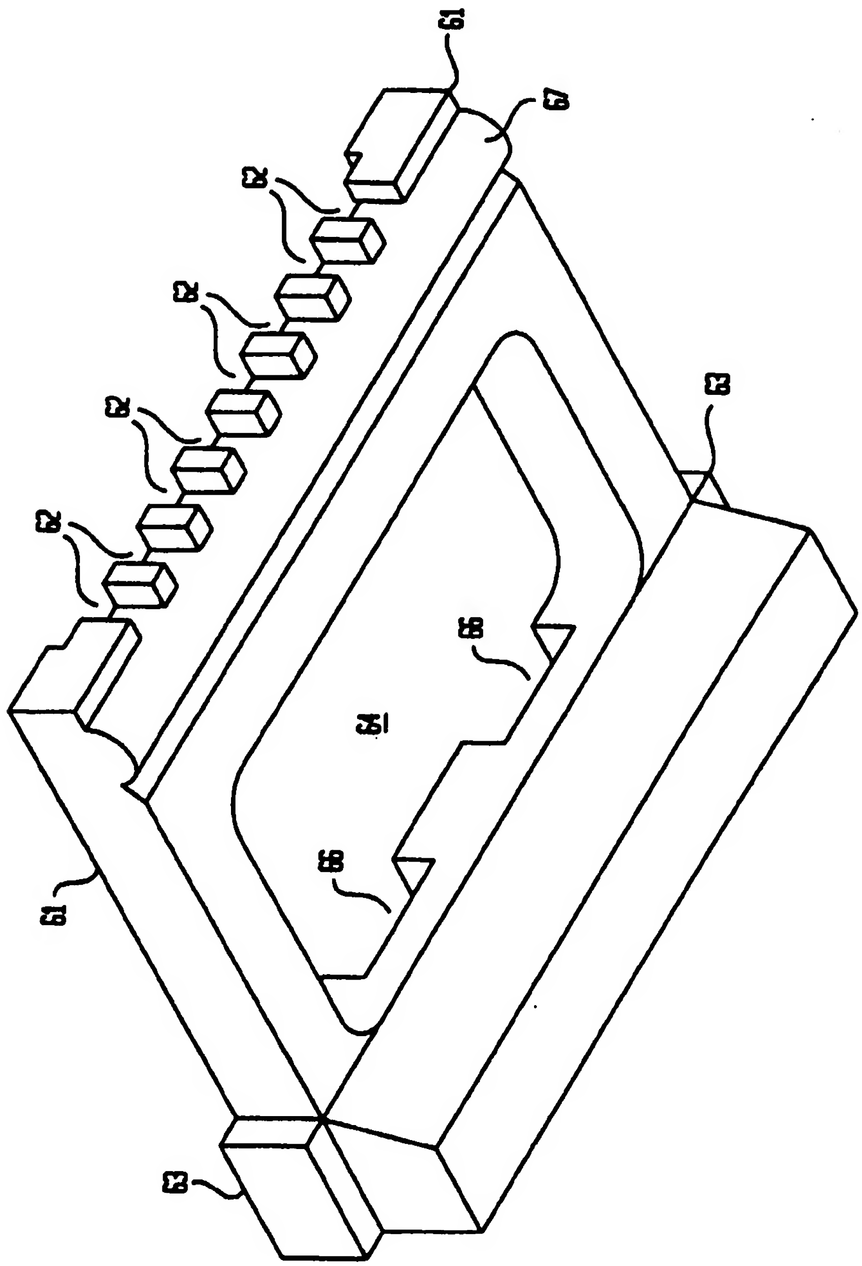

FIG. 8

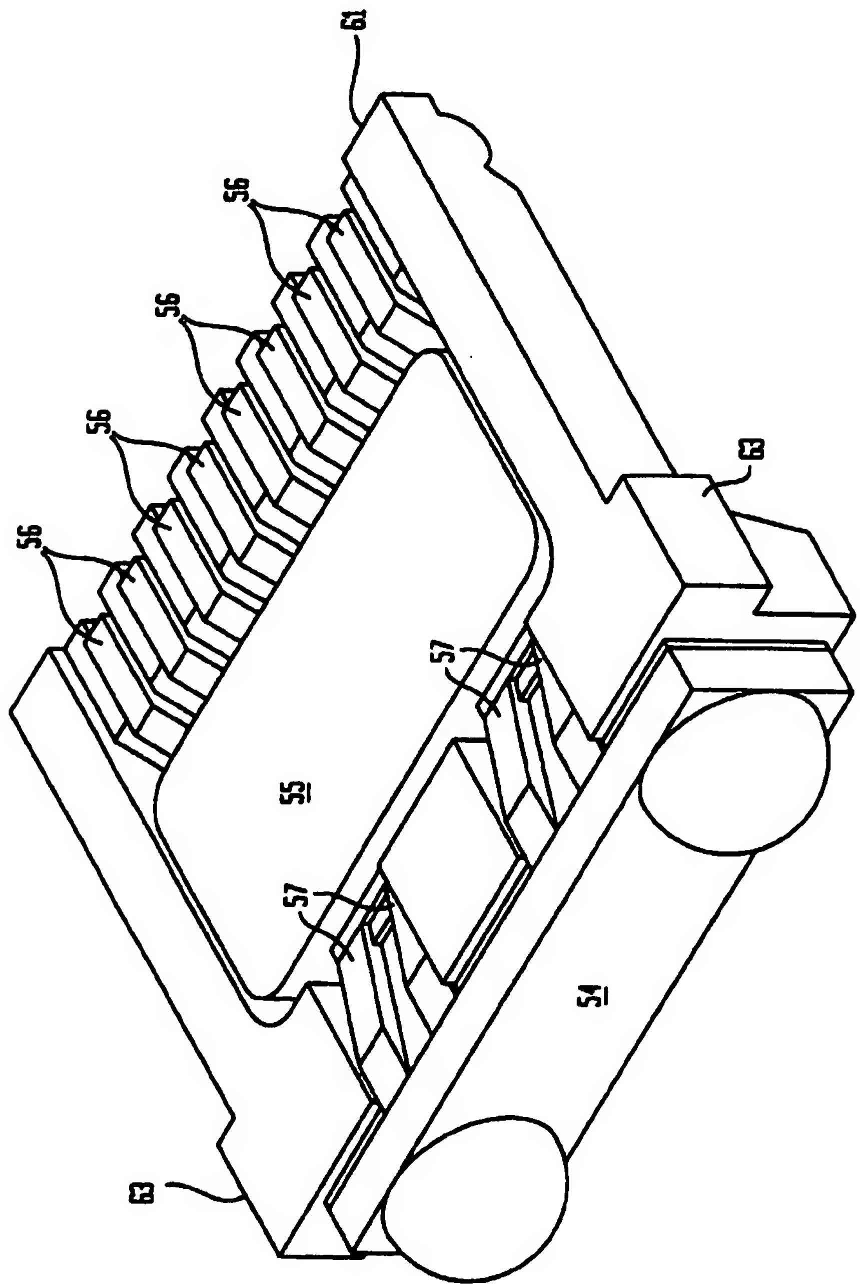

FIG. 9

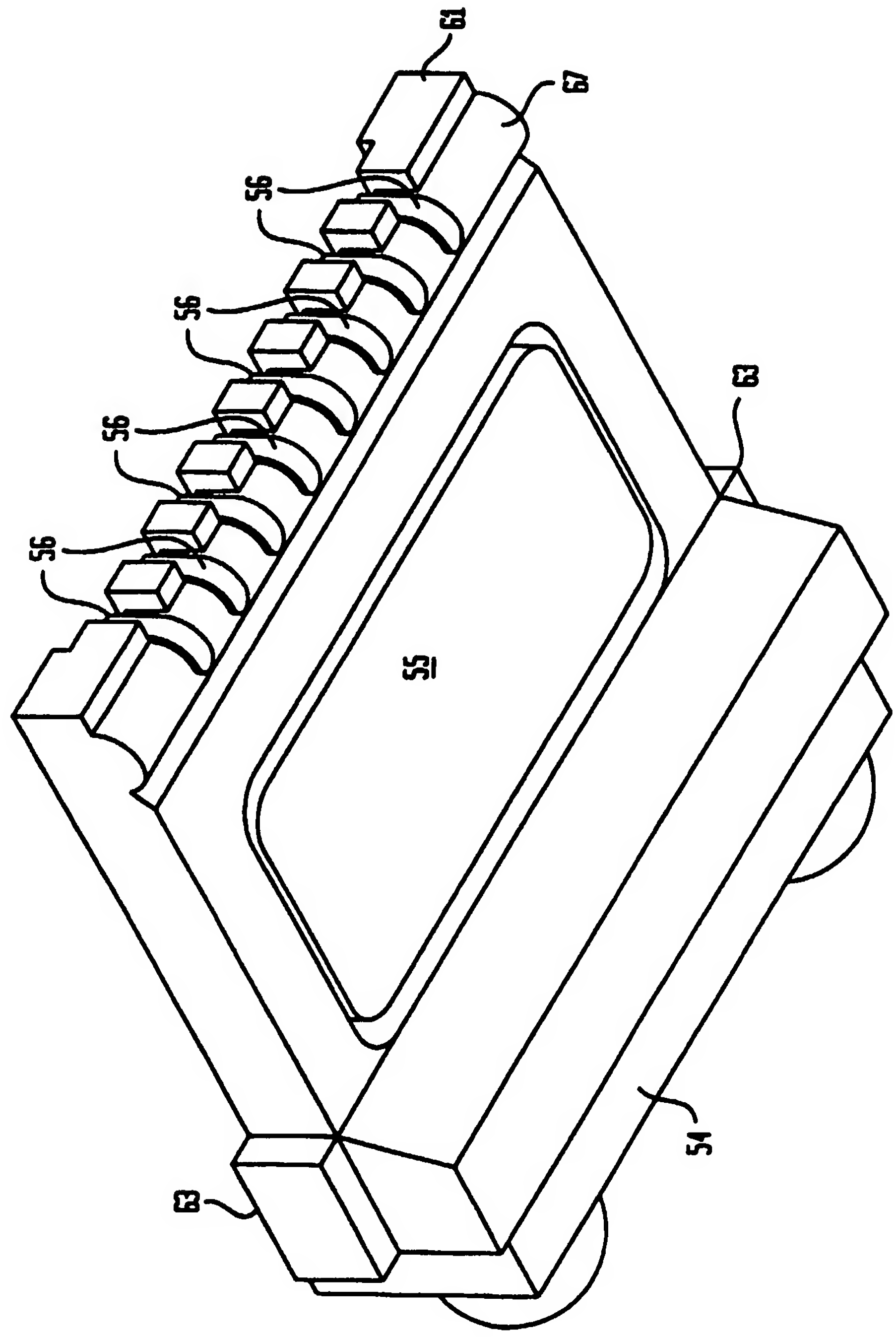

FIG. 5

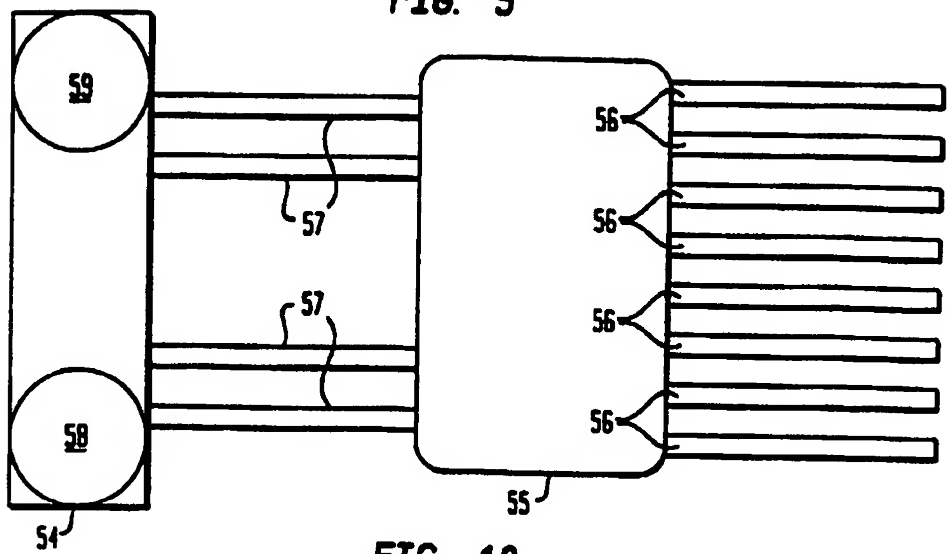
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FIG. 10

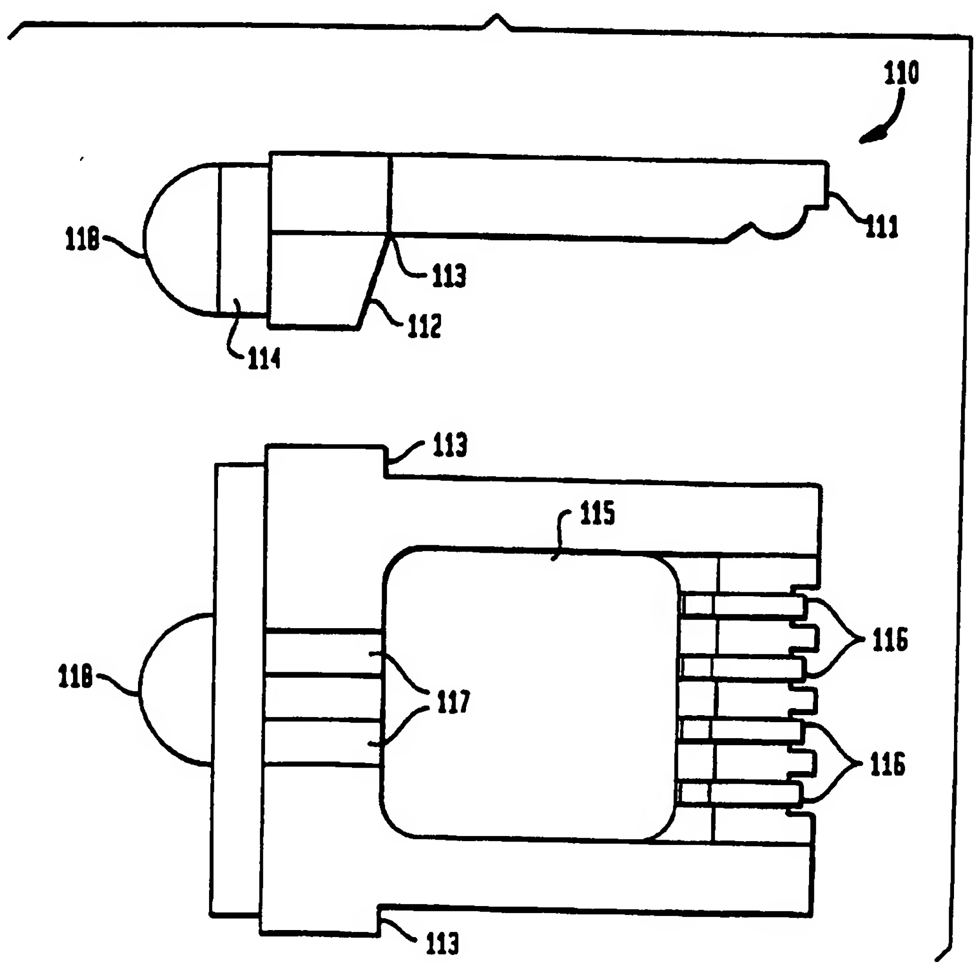
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FIG. 11

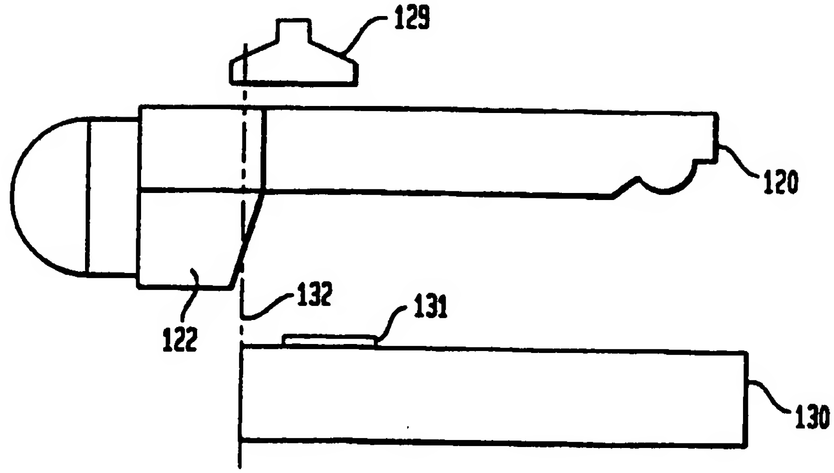

FIG. 12

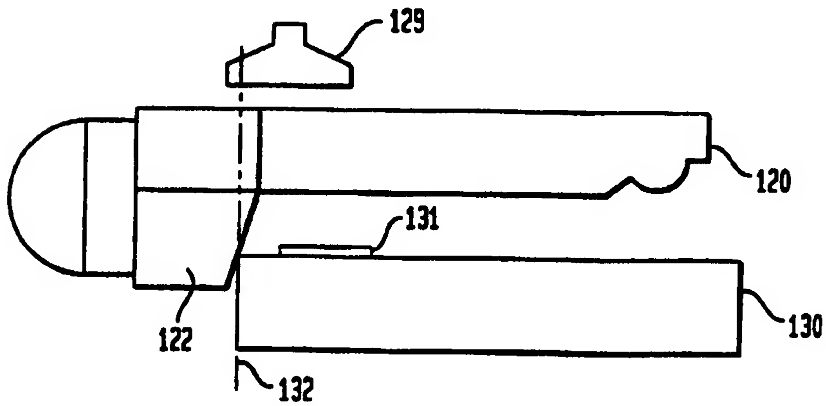

FIG. 13